



A CONTRIBUTION

TO

SCHOOL HYGIENE.

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A Paper

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BY

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OPHTHALMIC SURGEON AND LECTURER TO ST. THOMAS'S HOSPITAL.

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# A CONTRIBUTION TO SCHOOL HYGIENE.

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SEVERAL of the members of this Society have gone so carefully into the important questions of School Hygiene, such as ventilation, heating, etc., that they are better qualified than I am to speak on these subjects. I shall therefore confine myself to calling your attention to the importance of a question which, it seems to me, has not until now met with due notice. I am speaking of the posture of children during school-time.

If grown-up persons daily remain for hours in a stooping position, the unfavourable effect often shows itself in a disturbance of the respiratory or digestive organs. With children the hurtful influence is not limited to the functions, but extends to the shape and position of these organs. I will show you the way in which this occurs on two quite different parts of the body, the eye and the spine. The alterations which these two organs can undergo under the influence of bad posture are chiefly short-sightedness, and scoliosis, or lateral curvature of the spine; and in mentioning these two affections together, I by no means choose two examples unconnected with each other. Both anomalies are developed during school-time, and are incomparably more frequent in the educated than in the uneducated classes. Both are under the influence of

hereditary predisposition, but developed in a stronger or lesser degree, according to the habitual posture of the children; and, lastly, they act directly on one another, inasmuch as the lateral curvature of the spine favours short-sightedness, and short-sightedness increases the curvature of the spine. I have therefore found myself obliged to examine the spine, in a question where my intention was originally directed only to the eye.

Short-sightedness is produced by the lengthening of the antero-posterior axis of the eye. This lengthening originates under the influence of an increased tension of the apparatus by which we adapt our eyes to the different distances. The tension of this apparatus is stronger in proportion as the distance is shorter to which the eye is adapted. During childhood this apparatus possesses a great power of accommodation. If this power is made use of for adapting the eye continuously to a much shorter distance than would be required, that is to say, if, in reading or writing, the eyes, instead of at twelve to fifteen inches, are kept at four to six inches distance from the book, the sclerotic, that is the membrane which keeps the globe of the eye in its shape, giving way by degrees to the pressure, gradually extends in its posterior portion. Thus the shape of the eye becomes oval, and the retina is somewhat removed from the optic media from the cornea and the lens. The retina then only receives the images of near objects; distant objects appear undefined, and can only be seen by the aid of concave glasses, whose negative focus corresponds with the degree of short-sightedness.

Short-sightedness is developed almost exclusively during school-life; rarely afterwards, and very rarely before that time. Is this coincidence of time accidental?—*i.e.*, does the short-sightedness arise at the period about which children go to school? or has school-life caused the short-sightedness? Statistical inquiries prove the latter to be the case, and have

shown, at the same time, that the percentage of short-sighted children is greater in schools where unfavourable optical conditions prevail.

It is true that short-sightedness is often hereditary, but this must not be thought to mean that the children of short-sighted parents are born short-sighted. They have only the predisposition to become so, and this predisposition is developed during school-life, more or less, according to certain external conditions ; and the more so, of course under conditions which tend to produce short-sightedness even in children who have no hereditary predisposition.

If the predisposition is thus hereditary, and new cases are continually added, we can easily understand that short-sightedness in general must be continually on the increase. This, with regard to civilized countries, is an established fact.

The influence of school-life on the lateral curvature of the spine is as evident as its influence on short-sightedness. I am, of course, not referring to any of the curvatures which are the consequence of diseases of the bones and constitutional affections. I only mean to speak of those slight curvatures which during school-life develop themselves in quite healthy children, and which are so frequent that they have a strong title to the notice of all those who are interested in the national health.

Parents generally become aware of the fact by a difference in the shoulders of a child. Careful examination shows, however, that some of the ribs of the right side are more projecting than those of the other side, in the part close to the spine. The spine shows a slight deviation where those ribs are attached to it. But though this curvature is the very reason of the deformity of figure just mentioned, yet it is in itself but little conspicuous. The reason is that we can only see the hindermost ends of the spinal processes ; and that these ends may still be lying nearly

straight, one upon another, while the bodies of the vertebræ themselves are deviating very considerably from the normal position. These latter indeed are so much altered in shape and position that they produce not only a curvature but also a twisting of the spinal column; and it is this very twisting which acts compensatingly on the position of the spinal processes.

In very strongly developed cases the curvature of the spine shows itself even in the spinal processes, which in the upper part are bent to the left, and in the lower part to the right. In such cases the upper part of the body appears shortened, and the thorax becomes twisted to the right, and unsymmetrical. Pains in the back, in the nerves which pass along the ribs, disturbances in the functions of the organs of the chest, as well as of the abdomen, sufficiently characterise this state as a real disease. This severe form of the disease is by no means rare; but nobody, without having paid special attention to this subject, would suspect the frequency of the slighter cases of curvature. And this very frequency, because of its gradual influence on the physical constitution of the nation, is a fact of the greatest importance; although the single case in itself may happen to have no injurious consequences, and even remain unnoticed.

The slight cases of lateral curvature are far more frequent amongst girls than with boys; the more rapid development of the former giving the bad posture a more hurtful influence on the formation of the body; whereas the games and bodily exercises of boys, are a continual antidote, which is almost entirely wanting in the case of girls. Moreover there are anatomical differences in the strength of the muscles and in the structure of the bones, by which the greater tendency to lateral curvature in the female sex is explained.

All authors agree in thinking bad posture the chief reason of this affection. They principally lay stress upon individual habits, such as resting on one foot

while standing, using chiefly the right arm, and so forth. These latter circumstances, it seems to me, are of very subordinate importance ; the abnormal posture of the children during school time, and especially while writing, being the real cause of the evil. For children who have their lessons at home, the posture during writing may vary individually ; but for schools it is the same almost throughout. Modifications are only produced by either the left, or the right, or both elbows being ordered to rest on the table. In most cases the resting of both elbows is quite out of the question, the twenty inches allowance not being sufficient for it. In a few schools the children are compelled to sit with the right elbow placed on the table ; but as a rule they are told to bear on the left elbow. Now almost without exception, we shall observe the following process :

First position : The left elbow is put on the table close to the edge ; in consequence, the upper part of the body is twisted to the right, and in the mean time leans forward more or less, according to the greater or shorter distance between bench and table ; the right hand lies on the copybook, whilst, in proportion to the narrowness of the space allotted, the right elbow is held close to the ribs. So far, the head is still tolerably straight.

Second position : The head bends forward, and at the same time is gradually lowered ; the elbow is pushed forward, and the upper part of the body still more twisted to the right. The ribs of the left side are leaning against the edge of the table.

Third position : The copy-book is pushed forward, especially its right border, so that it is no more parallel to the edge of the table, but is inclined to it at an angle of  $45^{\circ}$  or more. The head is lowered, and at the same time twisted so much, that the left eye is only a few inches distant from the book ; the left cheek almost touches the hand, and sometimes actually leans on the fist ; meanwhile the thorax is partly suspended on the left shoulder, partly with the ribs of the

left side leaning on the edge of the table and bent far over the top. With the taller boys the seat glides over the hindermost edge of the bench, so that only the legs are supported by the bench, forming a very pointed angle with the upper part of the body. This is the moment where the teacher thinks it going too far, and he calls out "keep straight;" the pupils at once assume their first position, in order to relapse gradually into the second, and finally into the third, more or less quickly according to their size and strength. When at work by themselves in their private studies, they make up for the constraint of this habitual fatigue by indulging in the most extraordinary positions, which, sometimes, are difficult enough to define, mechanically as well as anatomically. They will rest the head on one or both hands; or crossing the arms, will lean forward on the table with both elbows, supporting the chin on the crossing point of the two hands; meanwhile the upper part of the body is so bent, that the vertebral column is changed into a semi-circle; the feet are drawn below the chair, or twisted round the forelegs of the latter. I once happened to observe the following characteristic position. The upper part of the left leg resting on the edge of the chair, the left foot twisted round the left foreleg of the chair, the left elbow resting on the left knee; the left hand on the edge of the table, the head resting on the hand; the book lying on the table perpendicularly to its edge, instead of being parallel to it; the right arm pushed forward so far, that the edge of the table was projecting into the axilla.

At first sight such a position might appear infinitely more hurtful than that required in the class-rooms. That is not the case, however; for as long as a position may be altered at any moment, it is comparatively innocuous, because one group of muscles being tired, another will be called into action by involuntarily assuming another position.



In class-rooms, on the contrary, the pupils are systematically forced, every day, for several hours, into the same unhealthy posture, over-tiring always the same muscles, twisting and bending the spine always at the same place, and thereby gradually altering the shape and position of the bones. Some private teachers and parents, instinctively understanding this, have made it a rule for the children to change their posture constantly; and compared to the system before mentioned, this is not a bad plan. Yet I do not mean to recommend it, myself; for although bad posture constantly modified is far preferable to one less unfavourable, which remains unmodified, yet the best posture is of course that which is at once healthy and fit to be retained throughout, and such a one it is possible to obtain.

The following, it seems to me, are the conditions required for a normal position :—

The upper part of the body is to be kept straight, the vertebral column neither twisted to the right nor to the left; the shoulder-blades both of the same height, are, together with the upper arm, freely suspended on the ribs, and in no way supporting the body; both elbows on a level with each other, and almost perpendicular under the shoulder-joint, without any support; only the hands and part of the forearm resting on the table; the weight of the head freely balanced on the vertebral column, and not on any account bent forward, but only turned so much round its horizontal axis, that the face is inclined sufficiently to prevent the angle at which the eye is fixed on the book from being too pointed.

Nothing can be simpler and more natural than this position, which however it is impossible to obtain with the tables and benches hitherto in use.

The study of the conditions under which a normal position becomes physiologically possible has enabled me to design a system of desks which I shall afterwards show you.

The top of the desk has an inclination of  $20^{\circ}$  for writing ; for reading a greater inclination is required, viz., about  $40^{\circ}$ . This latter is obtained by turning up a flap of 5 inches in width, fixed to the front edge of the desk.

The height of the desk is the same for grown-up people as for the smallest children, the body of children of different sizes being adapted to the height of the desk by modifying that of the seat and of the foot-board fixed to the desk.

In private studies, in young ladies' schools and small boys' schools, this is brought about by means of a moveable chair, so constructed as to be easily adapted to the individual height of each child. For public schools, and in fact for all schools in which the pupils change their places, I have calculated the proportions for the average size of three different ages. Benches and desks are joined together and fixed in the right position and proportion to each other. All seats have backs, which, for the chairs of private studies, are carefully adapted to the form of the body ; for school-benches the backs only consist of a board of 3 inches in width, which, placed at the right height (2 inches higher with girls than with boys), sufficiently supports the lower joints of the spine to enable the pupils to keep permanently straight while reading and writing. The distance between the back of the seat and the table is made to suit the three different sizes, and is always just sufficient for the flap to come quite near the child while writing. By lifting up the flap an interval is produced between bench and table, giving the necessary space for rising and passing in and out.

A back to the chairs is indispensable for securing a straight posture. I was, therefore, not a little astonished at hearing several pedagogues express the opinion, that, in order to strengthen the back, it is necessary to accustom children to keep straight without support,

I reply to this: First, that it would indeed be very desirable that children should keep straight without support, but that we can easily convince ourselves of the fact that they never do; and, secondly, that we cannot demand of children, what even strong grown up persons are unable to bear for several hours, simply because the strength of the muscles of the back is not adequate to the task. If therefore this theory of strengthening the back by depriving it of support, has never been practically realised, the fault lies neither with the teacher, nor with the pupil, but simply in the impracticability of the scheme.

It is strange enough that such errors should last so long. I may here mention another widespread error, not less pertinaciously adhered to, the resting on the floor, or on an inclined board in young ladies' schools. This is a torture in itself, and, moreover, misses the aim it is meant to attain. This aim is: to rest the back, when tired, in a position where the weight would be taken from the vertebræ, and where those parts of the body which had momentarily lost their symmetry, would be gradually forced back into a symmetrical position. That, instead of attaining this end, the method has rather a contrary result, and, is moreover, generally disliked by the children, is explained by the following reason:

The vertebral column, in its normal shape, has certain regular curvatures, both in the sitting and in the lying down posture. If we lie with our back on any flat surface, our body touches it with only a comparatively small portion of its outline.

This small portion, therefore, has to bear a disproportionately great weight, and suffers inconvenience accordingly, while the non-supported parts of the vertebral column, are forced out of their normal curvature by the weight of the parts of the body resting on them.

This is at once fatiguing and hurtful. And yet,

even those who themselves have suffered from this procedure, are still found to cling to it.

In analysing this question I have come to the following result. If a hard surface is to give the back rest, without making it suffer, it must have certain curvatures so adapted to the normal shape of the body, that this latter is supported everywhere, and its weight equally distributed.

These curvatures I have carefully studied, and following their outlines, I have designed a couch adapted to the inclination of the body at an angle of  $45^{\circ}$ . For girls who have any predisposition to lateral curvature of the spine, it will be found useful to let them do every work that will admit of it, while reclining on such a couch at an angle of  $45^{\circ}$ . But this and all other remedial measures are not of so much importance as the avoidance of that common position in writing before-mentioned, in which the vertebral column of the spine is at once twisted and bent.

As the London School Board has adopted my system, you will soon, I hope, have an opportunity of seeing it in operation on a very large scale, and it will convince you how important it is for the health and bodily development of the children, to obtain a good posture by suitable school furniture.